Power Management Controls

Updated Project Plan

Bruce Nordman, Project Leader
Alan Meier, Principal Investigator
Lawrence Berkeley National Laboratory

The following is an updated project plan for the Power Management Controls project, for the period beginning November 2000 through the duration of the project. It is based on the work plan developed with the sponsor, the California Energy Commission (CEC), reworded for clarity and slightly amended based on feedback received to date.

Phase I involved assembling the PAC, conducting the Institutional Review, and preparing other marketing materials such as the web site, posters, etc. Note that some elements of Phase II have already begun and others will continue until the late stages of the project as new developments arise. Phases III, IV, and V will be more sequential, with Phase III expected to begin in late 2001. Phase II is necessarily the most detailed as it constitutes more of the project work and the later phase work depends on the results of Phase II.

PAC member input needed

We need your advice regarding items that should be added, deleted, or modified.

Phase II Primary Research (Subtask 2.2)

Continue outreach/marketing

We will continue to contact potentially interested individuals and organizations, both those identified to us individually, but principally through indirect means such as placing information about the project in (often online) newsletters of relevant industries. The latter will rely on people utilizing the web site to find out more about the project. We will also look to the PAC for suggestions on any additional information that should be placed on the web.

A special effort is needed to make contact with non-U.S. manufacturers, trade associations, possibly other national standards organizations, and others to ensure that the project meets global needs.

Assess Devices and Interfaces (Subtask 2.2a)

We will survey the current implementation of power management interfaces, inspecting different types of electronic office equipment, including computers (PCs and other), monitors, fax machines, printers, copiers, and scanners. We will identify which types of equipment currently have power management capability and which types do not have this capability today, but will likely have it in the future.

While office equipment is the focus of this project, we will review controls and power management in other types of consumer electronic devices to gain an indication of what is present and the consistency (or lack thereof) with office equipment.

For each equipment type with power management capability, the we will identify interface characteristics that the devices have, such as delay timers, day/time controls, responses to external inputs (such as occupancy or computer network activity), and whether the equipment controls itself or is controlled by another, specific type of equipment. For equipment that is

likely to gain power management capability in the future, we will forecast the interface characteristics each type of equipment could have and how it will likely be controlled.

Within each equipment type, we will survey a wide variety of brands and models to identify and evaluate their power management controls and indicators. We will research the specific features present in the interface, the terms and symbols used, implied behavior, helpful information provided in the interface (e.g. the relative amount of energy saving from different options), and the underlying metaphors used to communicate the idea of (and rationale for) power management. We will document the indicators that report to users whether power management is occurring, such as power lights changing color or blinking, displays dimming or turning off, textual or symbolic indicators on a display, changes in noise, vibration, or heat emissions, or summaries of power status over time. We will also document the degree of agreement between terms and symbols on screens and those used next to power switches on the same device.

We will inventory how controls are described or represented in information apart from the controls, themselves, such as in documentation (on-line, on paper, or otherwise) and marketing materials.

We will assess and document the physical locations of the controls (in hardware and software terms), as necessary. We will also assess and document the types of hardware interfaces that electronic office equipment has which also affect power management controls, as necessary. These hardware interfaces may include a high-resolution screen, as on a PC; a touch screen, as on some copiers; a small LCD or LED character display, as on some printers and copiers; or an interface accessed from a second device via network connections.

With the data gathered, we will categorize power management control elements and strategies to determine whether there are distribution patterns across device types, vintage, etc. With collected information on PCs and associated equipment stocks, we will deduce which control strategies are most prevalent.

Assessing and comparing interface elements raises a variety of design and behavior issues, such as needs of particular types of users, characteristics of particular devices, interactions with other types of modes (e.g. error or alert modes), and characteristics of transitions between modes. These deserve discussion and analysis and may be key in shaping project conclusions.

Conduct Literature Review and Initial Field Research (Subtask 2.2.b)

The literature review will be highly influenced by the PAC s assessment of what particular literatures are most needed for project success. We will look to the PAC (and other interested parties) to suggest particular individuals, organizations, or documents that should be included in our review. Topics which we expect to address include:

- Any existing literature which touches on power management user interfaces specifically.
- A sampling of general literature on user interfaces. We expect the literature to be helpful in identifying any cultural pitfalls that should be avoided when choosing symbols and words, and the degree to which redundant symbology may be more resistant to misinterpretation than single-symbol controls (e.g. use of both colors and symbols).
- The development of other relatively standard user interfaces (e.g., for convenience, safety or other goals) that may indicate pitfalls or opportunities to standardize power management interfaces. We will also take note of examples of failed or poorly executed standard interfaces for any lessons they hold.

To gain more insight into the human dimensions of controls, we will conduct structured interviews with a variety of typical office workers, management information system (MIS) managers, office equipment repair technicians, and energy managers to gather a range of opinions, behaviors, ideas and a general sense of the prevalence of these ideas and opinions. The structured interviews will determine these users reactions to power management controls and indications, their assumptions about them (to determine if they differ from reality), their opinions on how the controls and indications could be improved and on which controls and indications work particularly well. We will also test a variety of interface designs and elements on users to assess

the degree to which these designs and elements are understood, misinterpreted, or seen as confusing.

We will also conduct structured interviews with individuals responsible for designing power management interfaces and individuals that market the devices and must explain them to customers. These structured interviews will be conducted to determine why the particular implementations were chosen, what alternatives were discarded and why, and what is seen as a better or optimal user interface.

Contact Appropriate Standards Committees

Contact the particular technical committees that are responsible for standards of interest to us those for which we may suggest amendments or additions.

Reporting

A product of all of Phase II is a User Interface Assessment Report , which summarizes key results of each of these tasks. To make the results more accessible, we expect to issue smaller reports on particular topics, which may be revised periodically. This will allow important findings to be reported as they become apparent rather than having to wait until the main report is ready for distribution. We want manufacturers and industry groupings to be able to benefit from findings at the earliest possible date; they may wish to incorporate some findings into products and specifications before they are approved by the PAC or standards committees.

Phase III Initial Conclusions (Task 2.3, Develop, Test and Disseminate the Interface Standard for Industry Acceptance)

Develop Initial Conclusions about Proposed Interface Standards (Subtask 2.3.a)

We will develop an interface structure and interface details, which together comprise the interface standard. This structure will include the types of elements that the standard should include and their relationship to each other. We will seek logical groupings of devices or interface types that suggest specifications tailored to that group, based on both capability and need. We will identify other elements of the structure; such as concepts for which standard terms and symbols are needed, as well as overall principles from which the standards should be derived or with which they should be consistent. The structure will also define the intended limits of the standard. We will identify and document ways that related standard controls such as imaging could be structured.

We will identify one or more promising approaches for a standard power management user interface, and determine how these approaches would be implemented in the range of electronic office equipment. We will also develop interface details, which will fill out the interface structure with specifics such as standard terms and symbols, indicators, and operating metaphors. We will create mock-ups of the controls, both entirely new ones, and adaptations of existing controls to make them conform to the standard. The mockups will be presented as static, graphic images.

Reporting

We will prepare a Proposed Interface Standard containing both the interface structure and interface details, and a discussion of the rationale or reasons for the choices made. Important findings will be reported to the CEC and industry as they become apparent rather than waiting until the report is ready for distribution so that manufacturers can benefit from the findings at the earliest possible date.

Develop Field Test Plan

The role of Phase IV is to subject the refined standards to broad critical review by average users. This will help to determine how well they understand the standard and how easily they are able to modify it to their needs. To help prepare for Phase IV, a Preliminary Field Test Plan Outline will briefly describe:

- how users will be approached and recruited to participate in the test
- sample size of users
- which design elements and other aspects of the standard will be tested
- the expected start and end dates of the test period
- the methods for administering the test, the methods for collecting test data and ensuring data quality
- an explanation of how the test results will be evaluated.

The Preliminary Field Test Plan Outline will also discuss how we intend to encourage others to organize and conduct testing internationally and share the results.

Obtain Formal Industry Review and Revise (Subtask 2.3.b)

The second PAC meeting will include review of at least three documents prepared by this project the Preliminary Field Test Plan Outline, the User Interface Assessment Report, and the Proposed Interface Standard . These will be distributed in a timely fashion to allow PAC members to give them critical review, to consult with others in their organizations, and to provide full and informed comments. While face-to-face meetings are a valuable part of the process, findings will be reported back to the PAC and all relevant institutions on an ongoing basis. Many issues will be identified and addressed in this ongoing process.

At the second meeting, we will review research findings and summarize the main points and conclusions. Then, we will present the Proposed Interface Standard and its rationale for the choices made so that reviewers and those who will consider adopting the standard will best understand them. Incorporating comments made during the meeting, we will strive to reach a consensus among PAC members on the Proposed Interface Standard.

We will subsequently participate in second CEC Critical Project Review .

Reporting

We will prepare a Preliminary Interface Field Test Plan Outline.

Phase IV Field Tests

Conduct Field Tests (Subtask 2.3.c)

Based on input from the PAC and other equipment manufacturers, standards organization representatives and others, we will refine further the standard structure and details.

We will also incorporate PAC member comments and suggestions to prepare a Draft Field Test Plan, with review and revision based on CEC comments.

During the field testing we will document any user problems and substantial deficiencies that users identify. If time and the project budget permit, we may modify the standard further to overcome the perceived deficiencies and retest the revised standard to determine user response.

We will prepare a Field Test Report, which will include a summary of the test plan and test activities, findings, conclusions and recommendations for a Final User Interface Standard. The Field Test Report will be distributed to the PAC members and the CEC. Important findings will be reported to the CEC and industry as they become apparent rather than waiting until the report is ready for distribution so that manufacturers can benefit from the findings at the earliest possible date.

Reporting

We will prepare a Draft Field Test Plan, if needed a Final Field Test Plan, and a Field Test Report.

Obtain Formal Industry Review and Revise (Subtask 2.3.d)

At the third and final PAC meeting we will review the Field Test Report and strive to reach consensus among PAC for approval of the recommended Final User Interface Standard.

We will prepare a written Summary of the Final PAC Meeting, which discusses the extent the PAC reached general consensus the Final User Interface or whether there is substantial conflict among PAC members regarding the format and content of the standard.

Phase V Implementation

Disseminate results (Subtask 2.3.e)

The purpose of this subtask is to initiate processes to have the Interface Standard adopted by national and international standards organizations and by leading office equipment manufacturers. We will disseminate copies of the Final Interface Standard to all interested parties and post it on our web site.

We will contact leading equipment manufacturers, particularly those in California and offer to provide them with the Final Interface Standard. We will distribute it to all interested parties and will maintain a log of which manufacturers requested copies, and any that declined to receive it.

We will also continue our contact with relevant standards organizations, and conduct briefings, presentations at standards organization meetings to shepherd the proposed standard through appropriate national and international standards processes.

Reporting

A final report will summarize the project process, data, results, and conclusions. The final report outline is available on request.